

Abstract No. Cali0528

Inelastic Scattering of Carbon-containing Materials

W. Caliebe (NSLS)

Beamline(s): X21

Introduction: X-ray absorption spectroscopy is not only element-sensitive, but also sensitive to the oxidation state and local symmetry. In many cases, it is difficult to study the C K-edge in materials because the low energy of the C K-edge (284eV) requires UHV environment, but many samples disintegrate in UHV or ruin the sample-chamber. Inelastic X-ray scattering with 8keV photons is an alternative to direct absorption spectroscopy.

Methods and Materials: The experiment was done at beamline X21 with the standard spectrometer. The incident energy was tuned close to the backscattering energy of the Si(444)-reflection at 7908eV. The samples were thin foils of grafoil (a graphite modification with high surface and preferred orientation), a thin foil of Teflon, several foils of Kapton, and a thin piece of PMMA. The samples were not cleaned with alcohol or acetone, and just mounted in a small, evacuated sample-chamber with a base-pressure of 7torr. The absorption spectra were recorded by tuning the incident energy to the sum of the edge and 7908eV, and measuring the inelastically scattered photons with the high-resolution spectrometer. The energy resolution of the incident beam was 0.2eV, and the total energy resolution was 0.45eV.

Results: The spectra are shown in figure 1. The four samples show significant differences, which result from different bonding states of C in these four compounds. A detailed analysis is in progress.

Conclusions: Inelastic scattering is very useful to investigate the C K-edge in different compounds. These four prototype show significant differences, which can be used like a finger-print. Due to the high versatility of the sample environment in inelastic x-ray scattering (high pressure, humidity, low temperatures) and its sensitivity to bulk properties, this method can be used in other compounds, which cannot be investigated with conventional absorption spectroscopy. Limitations in the count-rate (24hours for each spectra in this case) can be overcome by using more analyzers and increasing the flux by increasing the energy resolution or using other facilities.

Acknowledgments: Research carried out at the National Synchrotron Light Source, Brookhaven National Laboratory, which is supported by the U.S. Department of Energy, Division of Materials Sciences and Division of Chemical Sciences, under Contract No. DE-AC02-98CH10886.

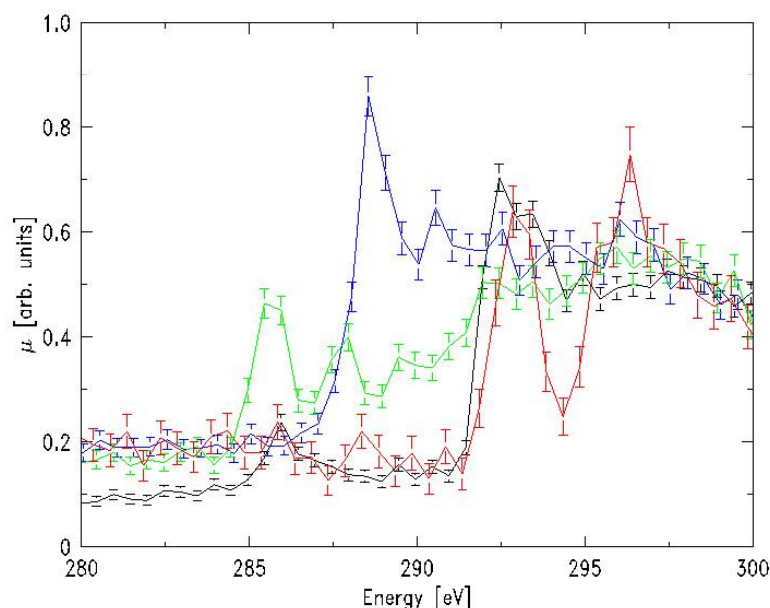


Figure 1: C K-edge in Grafoil (black), Kapton (green), PMMA (blue), and Teflon (red).